

MOBILE - AIR POLLUTION MONITORING SYSTEM

Submitted in partial fulfillment of the requirements
for
the award of
Bachelor of Engineering degree in Computer Science and Engineering

by

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SCHOOL OF COMPUTING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC I

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MARCH - 2021



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BONAFIDE CERTIFICATE

This is to certify that this project report is the bonafide work of **S SRIHARSHA REDDY (Reg. No. 37110652)** and **S VAMSI KRISHNA (Reg. No.37110656)** who carried out the project entitled "**MOBILE AIR POLLUTION MONITORING SYSTEM**" under my supervision from **December 2020** to **March 2021**.

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I **S SRIHARSHA REDDY** hereby declare that the Project Report entitled “**MOBILE AIR POLLUTION MONITORING SYSTEM**” is done by me under the guidance of **Dr.P.Asha,M.E.,Ph.d.**, Department of Computer Science and Engineering at Sathyabama Institute of Science and Technology is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Computer Science and Engineering.

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ABSTRACT

The main obstacle in the current scenario is reduction of pollution in the air. This pollution in air carries very harmful particles which can harm the breathing system. Pre-birth openness to pollution in air has appeared to build the danger of panting and asthma improvement in kids. Diminishing generally speaking degrees of provincial air pollution through open strategies, setting up activities to diminish local area openness, building cushions between significant streets and the surroundings areas and limiting self to very own openness to the contaminating in air and thereby reducing the endangerment of creating asthma in youngsters as well as grown ups. Existing observing frameworks have second rate accuracy very less affects, and should have the facility for researching the available frameworks, in regarding this we put forth the framework air pollution which is in third stage air pollution framework. This paper presents an Internet of Things (IoT) based wearable gadget incorporated with ease sensors and customer evaluated gadgets alongside a phone portable organization for ceaseless observing and the executives of asthma patients. Versatile application is actualized in this undertaking and this application is accustomed to checking pollution level noticeable all around. More sensor hub is utilizing to observing the general traffic pollution level in the specific region. This proposed framework is utilized to keep individuals from air pollution. Lessen the degree of adulteration from those origins and to shield people and the climate from unsafe gases.

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LIST OF ABBREVIATIONS

BCM2837	Broadcom2835
VA	Visual Analytics
IPL	Image Processing Library
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
DMA	Direct Memory Access
ARM	Advanced RISC Machine
RISC	Reduced Instruction Set Computer

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CHAPTER 1

INTRODUCTION

Wireless sensor networks (WSNs) are progressively affecting everyday living. A WSN is a network consisting of sensor nodes. Each sensor can detect certain factors like air pressure, air composition, and water quality. WSNs are used in a wide variety of settings, including personal space, industrial floors, agriculture, home utility monitoring systems, factory automation, automotive, and many other fields. WSNs are related to the concept of IoT. In IoT, devices are interconnected to transmit data via distributed sensor networks. IOT has useful applications in the medical field. Devices such as smartphone and sensing systems can be associated to create an infrastructure that provides access to health care information and services. This approach is referred to as “Mobile-Health”. Mobile-Health can be viewed as the consequence of the convergence of wireless communication systems, WSNs, and global computing tools.

Governments and Citizens are looking for scientific intellect to challenge the common threat of pollution in its many procedures. Currently mobile apps are able to accomplish functions like reporting status of air quality, air quality forecasts, air quality monitoring in a particular area, and risks highlighting connected with threshold breaking quality, etc.

There are also mobile apps designed for mass polluting sectors like industries. Industries or corporate organizations are now able to integrate and streamline environmental processes [7], including air emissions analyses, water and energy management, and waste reduction specific to them, through such apps.

Around 90 % of the population in low and center wage nations is presented to perilous levels of encompassing air contamination. The World Bank works with creating nations and advancement accomplices to diminish contamination by supporting checking and examination, administrative changes, and ventures. In 2016 for instance, the Bank conferred US\$1 billion to enable China to enhance air quality by lessening discharges of particular air poisons from mechanical, transport and country sources in the territory of Hebei, and by expanding vitality effectiveness and clean vitality through imaginative financing in the Beijing-Tianjin-Hebei district (otherwise called Jing-Jin-Ji locale) that covers the capital region and neighboring regions.

Death associated with encompassing air contamination have expanded in intensely populated, quick urbanizing areas, while death identified with cooking and warming homes

with strong energizes have stayed consistent in spite of advancement additions and upgrades in wellbeing administrations. Illnesses credited to the two sorts of air contamination caused 1 of every 10 deaths in, at least 2013 than six times the quantity of death caused by intestinal sickness.

The Cost of Air Pollution: Strengthening the financial case for activity, a joint investigation of the World Bank and the Institute for Health Metrics and Evaluation (IHME), looks to appraise the expenses of unexpected losses identified with air contamination, to fortify the case for activity and encourage basic leadership with regards to rare assets. An evaluated 5.5 million lives were lost in 2013 to illnesses related with outside and family unit air contamination, causing human enduring and decreasing financial improvement.

While pollution-related deaths strike mainly young children and the elderly, premature deaths also result in lost labor income for working-age men and women. The report finds that annual labor income losses cost the equivalent of almost 1 percent – 0.83 percent -- of Gross Domestic Product (GDP) in South Asia. In East Asia and the Pacific, where the population is ageing, labor income losses represent 0.25 percent of GDP, while in Sub-Saharan Africa, where air pollution impairs the earning potential of younger populations, annual labor income losses represent the equivalent of 0.61 percent of GDP.

The proposed work proposed IoT roadside air pollution monitoring system. Mobile app is used to monitor harm full gas in the air and it is plotted the graph. The gas sensor values are will send to the cloud for alerting people. This system is implemented, most traffic areas and traffic signal areas.

CHAPTER 2

LITERATURE SURVEY

Project Title: Can commercial low-cost sensor platforms contribute to air quality monitoring and exposure estimates?

Author Name: Nuria Castell, Franck R. Dauge,

Year Of publish : 2016

Abstract: The emergence of low-cost, user-friendly and very compact air pollution platforms enable observations at high spatial resolution in near-real-time and provide new opportunities to simultaneously enhance existing monitoring systems, as well as engage citizens in active environmental monitoring. This provides a whole new set of capabilities in the assessment of human exposure to air pollution. However, the data generated by these platforms are often of questionable quality. We have conducted an exhaustive evaluation of 24 identical units of a commercial low-cost sensor platform against CEN (European Standardization Organization) reference analyzers, evaluating their measurement capability over time and a range of environmental conditions. Our results show that their performance varies spatially and temporally, as it depends on the atmospheric composition and the meteorological conditions. Our results show that the performance varies from unit to unit, which makes it necessary to examine the data quality of each node before its use. In general, guidance is lacking on how to test such sensor nodes and ensure adequate performance prior to marketing these platforms. We have implemented and tested diverse metrics in order to assess if the sensor can be employed for applications that require high accuracy (i.e., to meet the Data Quality Objectives defined in air quality legislation, epidemiological studies) or lower accuracy (i.e., to represent the pollution level on a coarse scale, for purposes such as awareness raising). Data quality is a pertinent concern, especially in citizen science applications, where citizens are collecting and interpreting the data. In general, while low-cost platforms present low accuracy for regulatory or health purposes they can provide relative and aggregated information about the observed air quality.

Project Title: Development of an IoT Environmental Monitoring Application with a Novel Middleware for Resource Constrained Devices

Author Name: Salvatore Gaglio , Giuseppe Lo Re

Year Of publish :2014

Abstract: The proposed work the development of a Mobile Health monitoring system is described. The system combines user location data with air quality information provided by a heterogeneous sensing infrastructure providing users with advises about their daily exposure to air pollutants. The highly dynamic integration of different kind of nodes, mostly characterized by rather constrained resources, of this application is crucial to implement the Internet of Things vision, and requires powerful and effective programming methodologies to abstract implementation of high-level distributed processing from hardware dependencies. We then describe our programming methodology and our novel middleware supporting distributed applications on constrained devices. Our development approach is based on distributed symbolic processing through executable code exchange among nodes, and permits to extend the capabilities of nodes even after their deployment

Project Title: Field calibration of a cluster of low-cost commercially available sensors for air quality monitoring. Part B: NO, CO and CO₂

Author Name: Laurent Spinellea, Michel Gerbolesa,

Year Of publish : 2017

Abstract: Linear/multi linear regression and supervised learning techniques, are compared. A cluster of either metaloxide or electrochemical sensors for nitrogen monoxide and carbon monoxide together with miniaturized infra-red carbon dioxide sensors was operated. Calibration was carried out during the two first weeks of evaluation against reference measurements. The accuracy of each regression method was evaluated on a five months field experiment at a semi-rural site using different indicators and techniques: orthogonal regression, target diagram, measurement uncertainty and drifts over time of sensor predictions. In addition to the analyses for ozone and nitrogen oxide already published in Part A [1], this work assessed if carbon monoxide sensors can reach the Data Quality Objective (DQOs) of 25% of uncertainty set in the European Air Quality Directive for indicative methods. As for ozone and nitrogen oxide, it was found for NO, CO and CO₂ that the best agreement between sensors and reference measurements was observed for supervised learning techniques compared to linear and multilinear regression. 2016 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY license(

Project Title: and Future Internet of Things Architecture: Current Challenges Direction of Research

Author Name: Burhanuddin, Ali Abdul-Jabbar Mohammed,

Year Of publish :2017

Abstract: The Internet of Things (IoT) is a new paradigm that can enable collecting and exchanging data that have never been attainable before. It able to communicate and report user's information in a more secure way. The reports of Cisco analysts estimate that the IoT will have more than 50 billion of smart sensors and other smart devices or gadgets, all connecting and communicating real time data on the internet by 2020. This will provide deeper insights with data analytics using the IoT paradigm to establish new business, enhance productivity and efficiency, and develop innovative revenue streams. Furthermore, the IoT architecture may combine features and technologies suggested by various methodologies. Since, this architecture is designed where the digital and real worlds are integrating and interacting constantly, various technologies are merged together to form IoT, such as; sensing technologies, pervasive computing, ubiquitous computing, internet protocols, smart objects, embedded parts, etc. When a regular device utilizes intelligent agents, it becomes a smart object. In this way, it is not only used to gather the environment information or interact with the physical world, yet more than that, it must be interconnected with various network devices to exchange and communicate data over the internet. Therefore, the significant measure of available data which is produced by the immense number of interconnected devices will offer opportunities to generate information that will deliver significant benefits to the economy, environment, individuals, and society. The proposed work, we present past, current, and future direction of IoT. This paper provides overview and clear examination of the IoT architecture paradigm with the description of its fundamental requirements along with the implementation challenges and future directions. Thus, it will open issues that will face the IoT by new world generation.

Project Title: Pollution Monitoring using Sensors and Wireless Sensor Networks : A Survey

Author Name: R.A.Roseline1, .M.Devapriya.

Year Of publish : 2013

Abstract: Pollution has been aggravated by developments that typically occur as countries become industrialized growing cities, increasing traffic, rapid economic development and

industrialization, and higher levels of energy consumption . The high

influx of population to urban areas, increase in consumption patterns and unplanned urban and industrial development has led to the problem of air pollution. Air pollution has significant influence on the concentration of constituents in the atmosphere leading to effects like global warming and acid rains. To avoid such adverse imbalances in the nature, an air pollution monitoring system is utmost important. Wireless Sensor Networks is an excellent technology that can sense, measure, and gather information from the real world and, based on some local decision process transmit the sensed data to the user. These networks allow the physical environment to be measured at high resolutions, and greatly increase the quality and quantity of real-world data and information for applications like pollution monitoring. The proposed work, a survey on pollution sensors and pollution monitoring systems using Wireless sensor Networks is presented

Project Title: Research Directions for the Internet of Things

Author Name: John A. Stankovic,

Year Of publish :2014

Abstract: Many technical communities are vigorously pursuing research topics that contribute to the Internet of Things (IoT). Today, as sensing, actuation, communication, and control become ever more sophisticated and ubiquitous, there is significant overlap in these communities, sometimes from slightly different perspectives. More cooperation between communities is encouraged. To provide a basis for discussing open research problems in IoT, a vision for how IoT could change the world in the distant future is first presented. Then, eight key research topics are enumerated and research problems within those topics are discussed.

Project Title: Urban Air Pollution Monitoring Using Wireless Sensor Networks: A Comprehensive Review

Author Name: Movva Pavani , P.Trinatha Rao

Year Of publish :2017

Abstract: Air pollution is evolving as a severe environmental concern due to its enormous impact on the well being of the people, universal environment and also on the global economy. Conventional air pollution systems are not able to provide air pollution data of high spatiotemporal resolution due to non-scalability and limited data availability. With the advances in the areas of Micro Electro Mechanical Sensor (MEMS) and Wireless Sensor

Network (WSN), the researchers proposed various state-of-the-art air pollution monitoring systems for measuring major air pollutants like CO₂, CO, O₃, SO₂, VOC and Particulate

Matter (PM) with better results. A comprehensive review of continuous air pollution surveillance of both indoor and outdoor pollution by employing WSN is presented. It presents the various techniques and algorithms employed in the design of dedicated air pollution monitoring systems using WSN. A comprehensive and detailed review of the existing methods of Air Quality Monitoring systems using WSN is done along with their comparisons

Project Title: Using SWE Standards for Ubiquitous Environmental Sensing: A Performance Analysis

Author Name: Alain Tamayo , Carlos Granell

Year Of publish :2012

Abstract: Although smartphone applications represent the most typical data consumer tool from the citizen perspective in environmental applications, they can also be used for in-situ data collection and production in varied scenarios, such as geological sciences and biodiversity. The use of standard protocols, such as SWE, to exchange information between smartphones and sensor infrastructures brings benefits such as interoperability and scalability, but their reliance on XML is a potential problem when large volumes of data are transferred, due to limited bandwidth and processing capabilities on mobile phones. In this article we present a performance analysis about the use of SWE standards in smartphone applications to consume and produce environmental sensor data, analysing to what extent the performance problems related to XML can be alleviated by using alternative uncompressed and compressed formats.

Project Title: Wireless Sensor Network and its Applications in Automobile Industry

Author Name: Divyata Khachane, Anjali Shrivastav

Year Of publish :2016

Abstract: Wireless sensor network have gained much attention in recent years and now a days it is used in applications of various domain which leads to development of smart sensors. These sensors are small, having limited processing and computing resources, and they are inexpensive as compared to traditional sensors. These sensor nodes can sense, measure, and collect information from the environment and, based on some control decision process and transmit the sensed data to the user. Hence wireless sensor network also leads to research of smart sensors that are used in emerging applications. By using

its applicability, automobile industry is advancing rapidly. The proposed work, three automobile applications of wireless sensor network such as Car theft control, Automobile

pollution control, Headlight Intensity Control are explained in detail

Project Title: A mobile application for assessment of air pollution exposure

Author Name: Giuseppe Lo Re, Daniele Peri,

Year Of publish :2014

Abstract: The proposed work the architecture of a mobile air quality monitoring system is introduced. A mobile application will act as a personal assistant, monitoring and giving advices about gas pollutants daily exposure. Currently in development stage as part of a larger air quality monitoring system project, the application will enable users to monitor their daily exposure to gas pollutants by combining user location data and urban air quality information provided by the network of fixed monitoring stations of the city of Palermo.

CHAPT

ER 3

3.1 EXISTING SYSTEM:

SYSTEM

ANALYSIS

In this existing system is IoT-Mobair App for pollution management, industries based specifically, streamline and integrate environmental processes, including air emissions analyses, water and energy management, and waste reduction. Such apps provide visibility for users, specifically industries into the risk of incidents such as chemical leaks, oil spills and toxic substances improper disposal, while compliance strengthening with environmental standards and regulations.

3.2 PROPOSED SYSTEM:

In this proposed system is roadside pollution monitoring system for asthma patients. We can also implement zero tolerance fast big data real-time stream analytical tools to process such a complex system. Mobile app is implemented in this project and this app is used to monitor pollution levels in the air. More sensor node is using to monitor the overall traffic pollution level in the particular area.

3.3 REQUIREMENT SPECIFICATIONS

The requirements specification is a technical specification of requirements for the software products. It is the first step in the requirements analysis process it lists the requirements of a particular software system including functional, performance and security requirements. The requirements also provide usage scenarios from a user, an operational and an administrative perspective. The purpose of software requirements specification is to provide a detailed overview of the software project, its parameters and goals. This describes the project target audience and its user interface, hardware and software requirements. It defines how the client, team and audience see the project and its functionality.

3.4 HARDWARE AND SOFTWARE

SPECIFICATION Software Requirement:

Language : Embedded 'C'

Compiler : Arduino IDE

Hardware Requirement:

- Arduino Uno
- LCD Display (16x2)-1
- MQ-7 -1

- MQ-5
- Temperature sensor-1
- Humidity sensor

3.5 BLOCK DIAGRAM

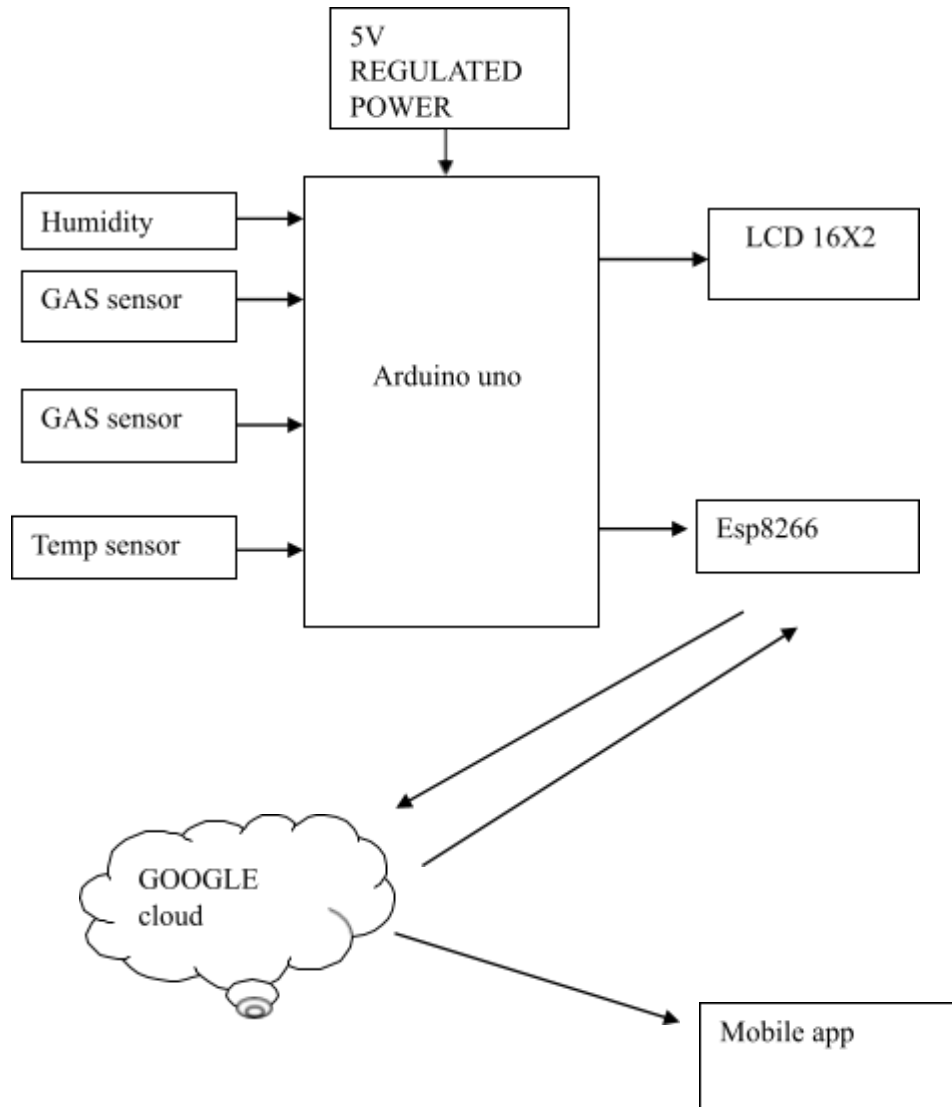


FIG 3.1

3.6 BLOCK DIAGRAM DESCRIPTION:

Above the block diagram is contain power unit, Arduino uno controller, MQ-7, MQ-5, and temperature sensor. Gas sensor and temperature sensor are interfacing with traffic system, then it gets monitored the pollution level in traffic area. This sensor is interfaced with Arduino uno analog pins. The controller, which process the sensor value and send to the server room and mobile app. Mobile app is used by people for monitoring air pollution level. The pollution level is increased the controller is intimate with people and traffic server rooms. This proposed system is used to prevent people from air pollution. Reduce

the level of pollution from such sources and to protect humans and the environment from harmful gasses, this air pollution kit was developed that helps a person to detect, monitor, and test air pollution in a given area.

CHAPTER 4

SYSTEM DESIGN

4.1 HARDWARE MODULES DETAILS:

Arduino Uno
LCD Display (16x2)-1
MQ-7 -1
MQ-5
Temperature sensor-1
Humidity sensor
Esp8266

4.1.1 ARDUINO UNO:

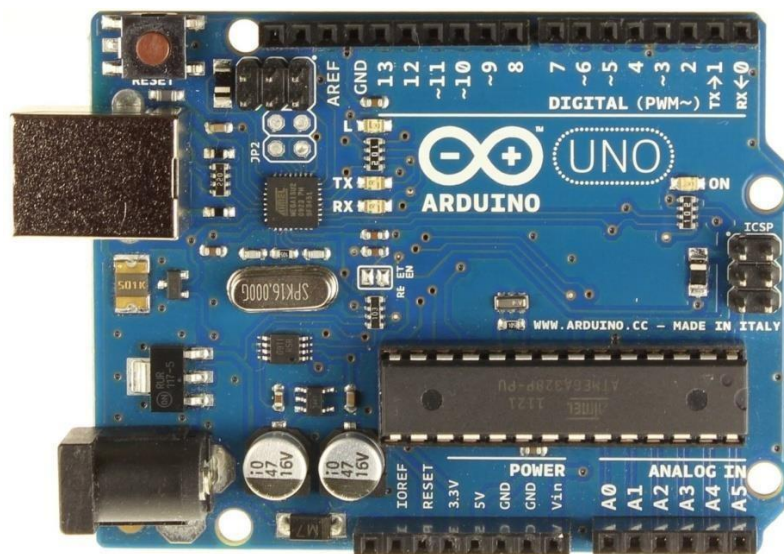


FIG 4.1 ARDUINO UNO

Specifications:

- The ATmega2560 is a Microcontroller
- The operating voltage of this microcontroller is 5volts
- The recommended Input Voltage will range from 7volts to 12volts
- The input voltage will range from 6volts to 20volts
- The digital input/output pins are 54 where 15 of these pins will supply PWM o/p.
- Analog Input Pins are 16

- DC Current for each input/output pin is 40 mA
- DC Current used for 3.3V Pin is 50 mA
- Flash Memory like 256 KB where 8 KB of flash memory is used with the help of boot loader
- The static random access memory (SRAM) is 8 KB
- The electrically erasable programmable read-only memory (EEPROM) is 4 KB
- The clock (CLK) speed is 16 MHz
- The USB host chip used in this is MAX3421E
- The length of this board is 101.52 mm
- The width of this board is 53.3 mm
- The weight of this board is 36 g

Key Benefits:

- Low cost
- Consistent board format
- 10x faster processing
- Added connectivity

Key Applications:

- Low cost PC/tablet/laptop
- IoT applications
- Media centre
- Robotics
- Industrial/Home automation
- Server/cloud server
- Print server
- Security monitoring
- Web camera
- Gaming
- Wireless access point
- Environmental sensing/monitoring (e.g. weather station)

PIN DIAGRAM:

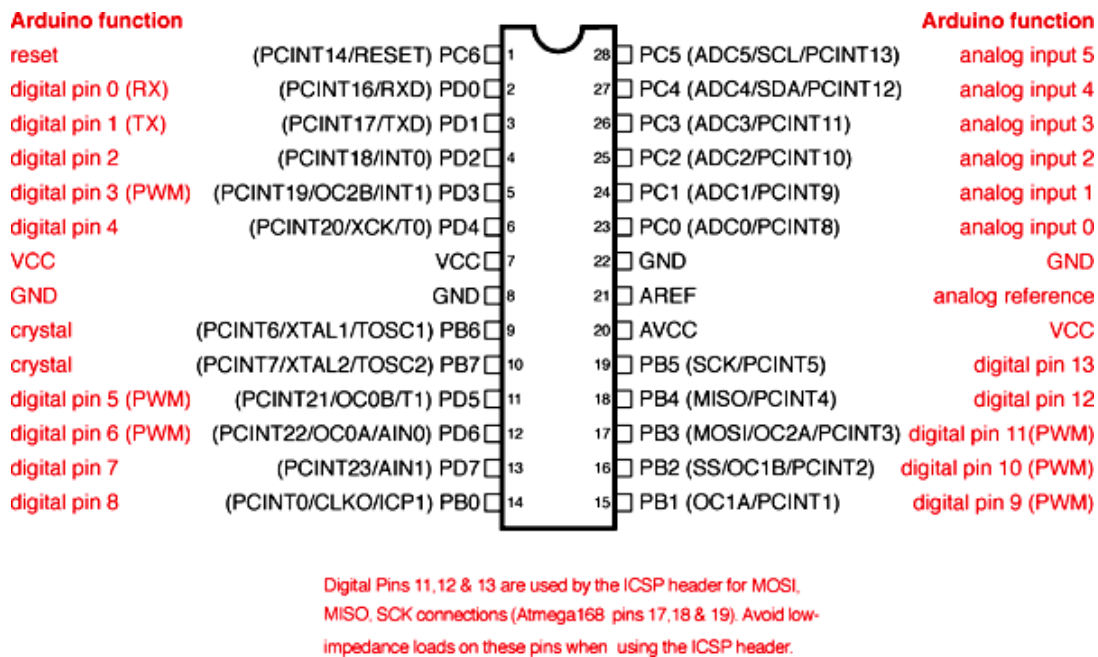


FIG 4.2 PIN DIAGRAM

ARDUINO UNO PERIPHERALS

1. Introduction

1.1 Overview

The Arduino uno is a microcontroller board based on the ATmega1280 (datasheet). It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The uno is compatible with most shields designed for the Arduino Duemilanove or Diecimila.

Schematic & Reference Design

EAGLE files: [arduino-mega-reference-design.zip](#)

Schematic: [arduino-mega-schematic.pdf](#)

Summary

Microcontroller	ATmega1280
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	54 (of which 15 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	128 KB of which 4 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz

Power

The Arduino uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

- **VIN.** The input voltage to the Arduino board when it's using an external power

source (as opposed to 5 volts from the USB connection or other regulated power

source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

- **5V.** The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
- **3V3.** A 3.3 volt supply generated by the on-board FTDI chip. Maximum current draw is 50 mA.
- **GND.** Ground pins.

Memory

The ATmega1280 has 128 KB of flash memory for storing code (of which 4 KB is used for the bootloader), 8 KB of SRAM and 4 KB of EEPROM (which can be read and written with the EEPROM library).

Input and Output

Each of the 54 digital pins on the uno can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

- **Serial: 0 (RX) and 1 (TX); Serial 1: 19 (RX) and 18 (TX); Serial 2: 17 (RX) and 16 (TX); Serial 3: 15 (RX) and 14 (TX).** Used to receive (RX) and transmit (TX) TTL serial data. Pins 0 and 1 are also connected to the corresponding pins of the FTDI USB-to-TTL Serial chip.
- **External Interrupts: 2 (interrupt 0), 3 (interrupt 1), 18 (interrupt 5), 19 (interrupt 4), 20 (interrupt 3), and 21 (interrupt 2).** These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.
- **PWM: 2 to 13 and 44 to 46.** Provide 8-bit PWM output with the analogWrite() function.
- **SPI: 50 (MISO), 51 (MOSI), 52 (SCK), 53 (SS).** These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language. The SPI pins are also broken out on the

ICSP header, which is physically compatible with the Duemilanove and Diecimila.

- **LED: 13.** There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
- **I²C: 20 (SDA) and 21 (SCL).** Support I²C (TWI) communication using the Wire library (documentation on the Wiring website). Note that these pins are not in the same location as the I²C pins on the Duemilanove or Diecimila.

The uno has 16 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and `analogReference()` function.

There are a couple of other pins on the board:

- **AREF.** Reference voltage for the analog inputs. Used with `analogReference()`.
- **Reset.** Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

Communication

The Arduino uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega1280 provides four hardware UARTs for TTL (5V) serial communication. An FTDI FT232RL on the board channels one of these over USB and the FTDI drivers (included with the Arduino software) provide a virtual com port to software on the computer. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the FTDI chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

A `SoftwareSerial` library allows for serial communication on any of the uno's digital pins.

The ATmega1280 also supports I2C (TWI) and SPI communication. The Arduino software includes a `Wire` library to simplify use of the I2C bus; see the documentation on the Wiring website for details. To use the SPI communication, please see the ATmega1280 datasheet.

Programming

The Arduino uno can be programmed with the Arduino software ([download](#)). For details, see the [reference](#) and [tutorials](#).

The ATmega1280 on the Arduino uno comes preburned with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files).

You can also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header; see these instructions for details.

Automatic (Software) Reset

Rather than requiring a physical press of the reset button before an upload, the Arduino uno is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the FT232RL is connected to the reset line of the ATmega1280 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the boot loader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload.

This setup has other implications. When the uno is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the boot loader is running on the uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data.

The uno contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line; see this forum thread for details.

USB Over current Protection

The Arduino uno has a resettable poly fuse that protects your computer's USB ports from

shorts and over current. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500 mA is applied to the USB

port, the fuse will automatically break the connection until the short or overload is removed.

Physical Characteristics and Shield Compatibility

The maximum length and width of the uno PCB are 4 and 2.1 inches respectively, with the USB connector and power jack extending beyond the former dimension. Three screw holes allow the board to be attached to a surface or case. Note that the distance between digital pins 7 and 8 is 160 mil (0.16"), not an even multiple of the 100 mil spacing of the other pins.

The uno is designed to be compatible with most shields designed for the Diecimila or Duemilanove. Digital pins 0 to 13 (and the adjacent AREF and GND pins), analog inputs 0 to 5, the power header, and ICSP header are all in equivalent locations. Further the main UART (serial port) is located on the same pins (0 and 1), as are external interrupts 0 and 1 (pins 2 and 3 respectively). SPI is available through the ICSP header on both the uno and Duemilanove

4.1.2 ESP8266:



Fig 4.3 ESP8266

The ESP8266 12-E chip comes with 17 GPIO pins. Not all GPIOs are exposed in all ESP8266 development boards, some GPIOs are not recommended to use, and others have very specific functions. With this guide, you'll learn how to properly use the ESP8266 GPIOs and avoid hours of frustration by using the most suitable pins for your projects.

ESP8266 Peripherals

The ESP8266 peripherals include:

- 17 GPIOs
- SPI
- I2C (implemented on software)
- I2S interfaces with DMA
- UART
- 10-bit ADC

Best Pins to Use – ESP8266

One important thing to notice about ESP8266 is that the GPIO number doesn't match the label on the board silkscreen. For example, D0 corresponds to GPIO16 and D1 corresponds to GPIO5.

The following table shows the correspondence between the labels on the silkscreen and the GPIO number as well as what pins are the best to use in your projects, and which ones you need to be cautious.

The pins highlighted in green are OK to use. The ones highlighted in yellow are OK to use, but you need to pay attention because they may have unexpected behavior mainly at boot. The pins highlighted in red are not recommended to use as inputs or outputs.

GPIOs connected to the Flash Chip

GPIO6 to GPIO11 are usually connected to the flash chip in ESP8266 boards. So, these pins are not recommended to use.

Pins used during Boot

The ESP8266 can be prevented from booting if some pins are pulled LOW or HIGH. The following list shows the state of the following pins on BOOT:

- **GPIO16:** pin is high at BOOT

- **GPIO0:** boot failure if pulled LOW

- **GPIO2:** pin is high on BOOT, boot failure if pulled LOW
- **GPIO15:** boot failure if pulled HIGH
- **GPIO3:** pin is high at BOOT
- **GPIO1:** pin is high at BOOT, boot failure if pulled LOW
- **GPIO10:** pin is high at BOOT
- **GPIO9:** pin is high at BOOT

Pins HIGH at Boot

There are certain pins that output a 3.3V signal when the ESP8266 boots. This may be problematic if you have relays or other peripherals connected to those GPIOs. The following GPIOs output a HIGH signal on boot:

- GPIO16
- GPIO3
- GPIO1
- GPIO10
- GPIO9

Additionally, the other GPIOs, except GPIO5 and GPIO4, can output a low-voltage signal at boot, which can be problematic if these are connected to transistors or relays. You can read this article that investigates the state and behavior of each GPIO on boot.

Analog Input

The ESP8266 only supports analog reading in one GPIO. That GPIO is called **ADC0** and it is usually marked on the silkscreen as **A0**.

The maximum input voltage of the ADC0 pin is 0 to 1V if you're using the ESP8266 bare chip. If you're using a development board like the ESP8266 12-E NodeMCU kit, the voltage input range is 0 to 3.3V because these boards contain an internal voltage divider.

You can learn how to use analog reading with the ESP8266 with the following guide:

On-board LED Most of the ESP8266 development boards have a built-in LED. This LED is usually connected to GPIO2.

4.1.3 GAS SENSOR:

In current technology scenario, monitoring of gases produced is very important. From home appliances such as air conditioners to electric chimneys and safety systems at industries monitoring of gases is very crucial. **Gas sensors** are very important part of such systems. Small like a nose, gas sensors spontaneously react to the gas present, thus keeping the system updated about any alterations that occur in the concentration of molecules at gaseous state.

Gas sensors are available in wide specifications depending on the sensitivity levels, type of gas to be sensed, physical dimensions and numerous other factors. This Insight covers a **methane gas sensor** that can sense gases such as ammonia which might get produced from methane. When a gas interacts with this sensor, it is first ionized into its constituents and is then adsorbed by the sensing element. This adsorption creates a potential difference on the element which is conveyed to the processor unit through output pins in form of current. What is this sensing element? Is it kept in some chamber or is kept exposed? How does it get current and how it is taken out? Let's find out in this Insight!!!



GAS SENSOR

The **gas sensor module** consists of a steel exoskeleton under which a sensing element is housed. This sensing element is subjected to current through connecting leads. This current is known as heating current through it, the gases coming close to the sensing element get ionized and are absorbed by the sensing element. This changes the resistance of the sensing element which alters the value of the current going out of it.

4.1.4 Power Supply:

Alternating current (AC) is used for power line transmission and for high power devices like appliances and lights. The characteristics of AC make it ideal for transmission over long

lines and for delivering large amounts of power for relatively unregulated uses, such as generating heat and light. Lower power appliances and devices require the closely regulated control of direct current power (DC). As a normal house is supplied with AC, it must be converted to DC for many uses. Use these tips to learn how to make an AC DC converter.

A transformer contains 2 magnetically coupled wire windings. One winding is called the primary. The primary is driven by the main AC supply. The other winding is called the secondary. The secondary serves as the power input to the AC DC converter. This transformer and all of the other items needed to build the AC DC converter are readily available at electronic stores and hobby stores.

- Size the transformer windings. AC mains provide 120 volts AC. If 120 volts AC were directly converted to a DC voltage, the resulting DC voltage would be far too high a voltage for use by appliances and devices. The primary and secondary windings of the transformer are scaled to each other in order to produce a lower voltage on the secondary winding.
- Choose a secondary winding. The AC output of the secondary winding should be rated as the same voltage of DC that is being created

Wire the primary winding of the transformer to the main AC supply. This transformer connection has no polarity and may be connected either way.

Connect the secondary winding of the transformer to a full wave bridge rectifier package. The transformer connections and the connections to the marked inputs of the rectifier package have no polarity and may be connected either way.

- Build a full wave rectifier. This rectifier can be built up from 4 discrete rectifying diodes, rather than using a rectifier bridge package. The diodes will be marked to show a positive (cathode) end and a negative (anode) end. Connect the 4 diodes into a loop. Connect the cathode of diode 1 to the cathode of diode 2. Connect the anode of diode 2 to the cathode of diode 3. Connect the anode of diode 3 to the anode of diode 4. Connect the cathode of diode 4 to the anode of diode 1.
- Wire the discrete rectifier to the transformer secondary. The transformer secondary should be connected to the cathode of diode 3 and the cathode of diode 4. There is

no required polarity for these connections. The positive output of the rectifier is at

the point where the cathodes of diodes 1 and 2 join. The negative output of the rectifier is at the point where the anodes of diodes 3 and 4 join.

Attach a smoothing capacitor. Attach a polarized capacitor across the output connections of the rectifier. The positive terminal of the polarized capacitor must connect to the positive output of the regulator. This capacitor should be sized such that the capacitance in farads (F) is equal to (5 times the current to be supplied by the AC DC converter) divided by (transformer secondary rating times 1.4 times frequency). Frequency varies from country to country, but is typically either 50 Hertz (Hz) or 60 Hertz.

Provide the final regulation. Choose a commercially available voltage regulator designed to control the output of the AC DC converter to the desired output voltage. The regulator will be a 3-pin device. The regulator pins will be a common, an input from the smoothing capacitor and an output of the regulator. This regulator output also will be the final output of the completed AC DC converter.

- Wire the regulator as directed in the manufacturer's data sheet. There probably will be a noise suppression capacitor specified in the regulator manufacturer's data sheet. Acquire and install that capacitor per the manufacturer's data sheet for the regulator.

Resistor

What is a Resistor?

An **electric resistor** is a two-terminal passive component specifically used to oppose and limit current. A resistor works on the principle of Ohm's Law which states that voltage across the terminals of a resistor is directly proportional to the current flowing through it.

Ohm's Law: **$V = IR$**

where V is the voltage applied across resistor,

I is the current flowing through it,

and R is the constant called resistance.

The unit of resistance is ohms.

Types of Resistors:

Resistors can be broadly classified based on the following criteria: the type of material used, the power rating and resistance value.

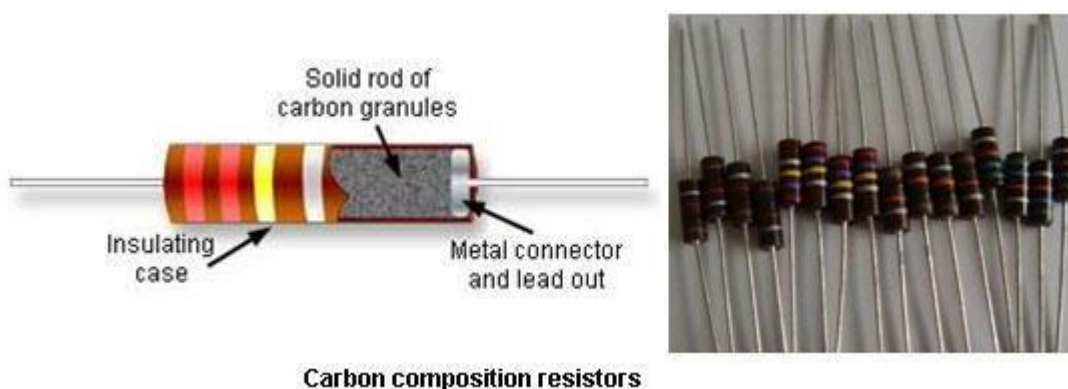
1. Fixed resistors.

In some scenarios, an electrical circuit may need a lesser amount of current to flow through it than the input value. Fixed resistors are used in these situations to limit the flow of current.

1.1 Carbon Composition Resistors:

These resistors are cylindrical rods which are a mixture of carbon granules and powdered ceramic. The resistor value depends on the composition of the ceramic material. A higher quantity of ceramic content will result in more resistance. Since the rod is coated with an insulated material, there are chances of damage due to excessive heat caused by soldering.

High current and voltage can also damage the resistor. These factors bring irreversible changes in the resistance power of these **resistors**. This **type of resistor** is rarely used nowadays due to their high cost and are only preferred in power supply and welding circuits.



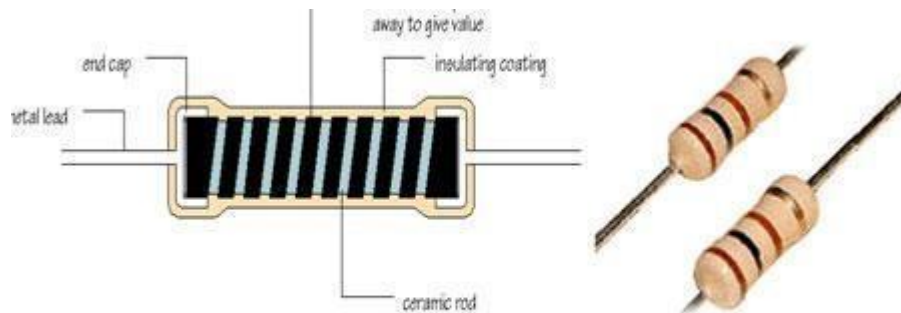
1.2 Carbon film resistors:

This **resistor** is formed by depositing a carbon film layer on an insulating substrate. Helical

cuts are then made through the carbon film to trace a long and helical resistive path. The

resistance can be varied by using different resistivity carbon material and modifying the shape of the resistor. The helical resistive path make these resistors highly inductive and of little use for RF applications.

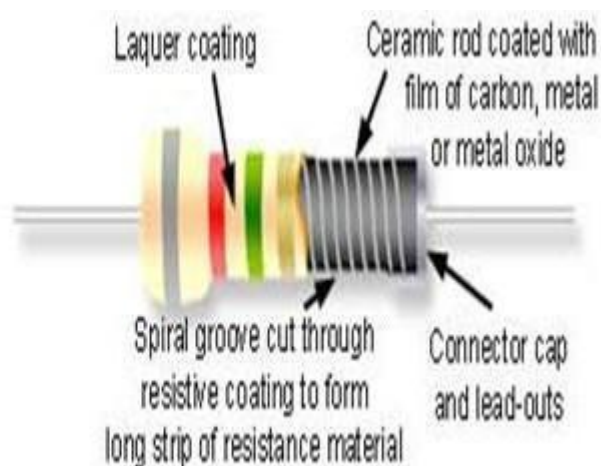
They exhibit a temperature coefficient between -100 and -900 ppm/ °C. The carbon film is protected either by a conformal epoxy coating or a ceramic tube. The operation of these **resistors** requires high pulse stability.



Carbon film resistors

1.3 Metal Film resistor:

These resistors are made from small rods of ceramic coated with metal (such as a nickel alloy) or metal oxide (such as tin oxide). The value of resistance is controlled mainly by the thickness of the coating layer (the thicker the layer, the lower is the value of resistance). A fine spiral groove can be cut along the rod using a laser to split the carbon or metal coating effectively into a long and spiral strip, which forms the resistor.



Metal film resistors

Metal film resistors can be obtained in a wide range of resistance values from a few Ohms to tens of millions of Ohms with a very small tolerance. For example, for a stated value of 100K Ohm, the actual value will be between 99K Ohm and 101K Ohm. Small carbon,

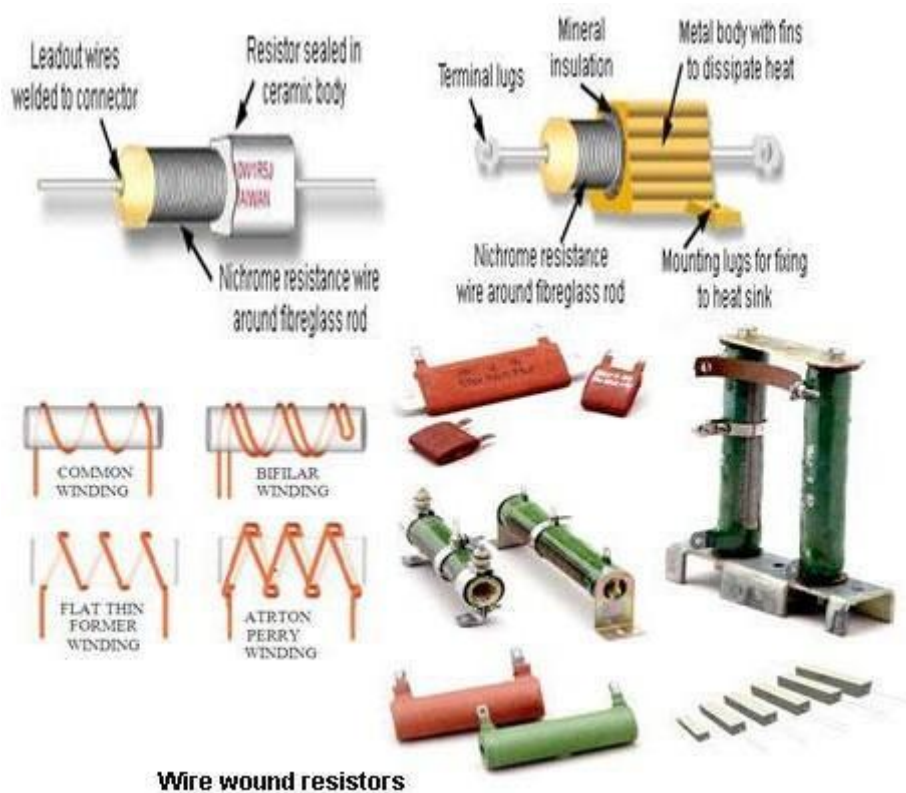
metal and oxide resistors come in various colors such as dark red, brown, blue, green, grey or white.

1.4 Wire wound resistor:

Wire wound resistors vary in size and physical appearance. Their resistive elements are commonly lengths of wire, usually an alloy such as Nickel/Chromium or Manganin wrapped around a small ceramic or glass fiber rod and coated in an insulating flameproof cement film. They are normally available in low values of resistance but are capable of dissipating large amounts of power.

These resistors can get very hot during use. For this reason, these resistors are housed in a finned metal case that can be bolted to a metal chassis to dissipate the heat generated. Protection from fire is important and fireproof cases or coatings are vital. Lead-out wires are normally welded rather than soldered to the resistor. Enamel resistors are used in scenarios where high power is involved and are encapsulated in heat proof bases.

Since wire wound resistors are primarily coils, they have more undesirable inductance than other types of resistor, although winding the wire in sections with alternately reversed directions can minimize inductance. Other techniques employ bifilar winding to reduce cross-section area of the coil. For the most demanding circuits, resistors with Ayrton-Perry windings are used.



Capacitor

Capacitor is a passive component used to store charge. The charge (q) stored in a capacitor is the product of its capacitance (C) value and the voltage (V) applied to it. Capacitors offer infinite reactance to zero frequency so they are used for blocking DC components or bypassing the AC signals. The capacitor undergoes through a recursive cycle of charging and discharging in AC circuits where the voltage and current across it depends on the RC time constant. For this reason, capacitors are used for smoothing power supply variations. Other uses include, coupling the various stages of audio system, tuning in radio circuits etc. These are used to store energy like in a camera flash.

Capacitors may be non-polarized/polarized and fixed/variable. Electrolytic capacitors are polarized while ceramic and paper capacitors are examples of non polarized capacitors. Since capacitors store charge, they must be carefully discharged before troubleshooting the circuits. The maximum voltage rating of the capacitors used must always be greater than the supply voltage. Click to learn more about [working of a capacitor](#) along with its internal structure.

Capacitor is a widely used electronic component. It stores electric charge and then

discharges it into the circuit. It blocks the direct current and allows the alternating current to pass through it. Depending on the purpose, there are a variety of capacitors being used like ceramic, electrolytic, mylar, mica, etc. We will explore an electrolytic capacitor through this article.

Structure of a Capacitor: A capacitor contains two conductor plates which are generally made of metal and an insulator between them. This insulator also known as dielectric is made up of material like paper, plastic, ceramic or glass. The two plates are electrically connected to the external circuit with the help of two thin metal rods also known as the legs of the capacitor.

These two plates are used to store charge between them. One is connected with positive voltage and other one with negative voltage. A capacitor is characterized by the parameter capacitance. Capacitance is measured as ratio of difference of charges between the plates and total voltage drop between the plates.

$$C = dQ/dV$$

The unit of capacitance is FARAD.

Let's have a closer look into the structure and how a capacitor is able to store charge.

Metal Container

Inside the metal case is a folded layer of dielectric in between metal plates. Next images give a clear perception of the internal structure of the capacitor.

Dielectric

In the above image, we can clearly see two different types of layers, folded like a swiss roll. A dielectric layer is sandwiched between two metal plates. These metal plates are used to store charge and the dielectric works as an insulator between them. These plates are folded round to minimize the size of the capacitor.

One plate works as cathode and another as anode. To increase the value of a capacitor and the same time to keep the size smaller, we use electrolyte. However depending on the size and application, there are different types of electrolytes used in different ways within a capacitor. Generally, anode is soaked into liquid electrolyte to increase the surface area of the plate as well as efficiency.

Crystal Oscillator

A quartz crystal resonator plays a vital role in electronics oscillator circuitry. Sometimes mispronounced as crystal oscillator, it is rather a very important part of the feedback network of the oscillator circuitry. Electronics oscillators are used in frequency control application finding their usage in almost every industry ranging from small chips to aerospace.

A quartz crystal is the heart of such type of resonators. Their characteristics like high quality factor (Q), stability, small size and low cost make them superior over other resonators like LC circuit, tuning forks, ceramic resonator etc.

The basic phenomenon behind working of a **quartz crystal oscillator** is the inverse piezo electric effect i.e., when electric field is applied across certain materials they start producing mechanical deformation. These mechanical deformation/movements are dependent on the elementary structure of the quartz crystal. Quartz is one of the naturally occurring materials which show the phenomena of piezo electricity, however for the purpose of resonator it is artificially developed since processing the naturally occurring quartz is difficult and costly process.

4.1.5 TEMPERATURE SENSOR:

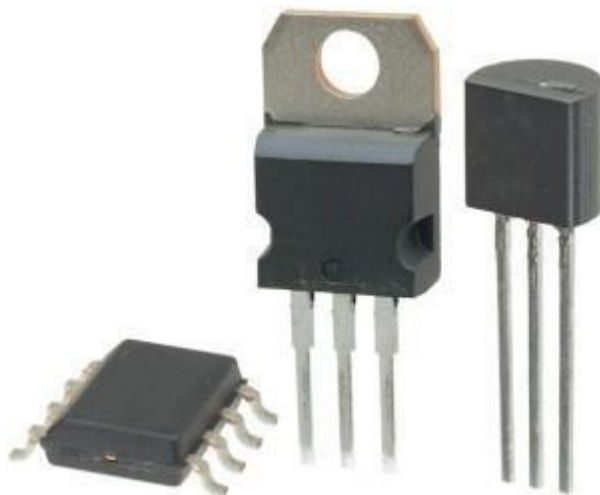


Fig 4.5 TEMPERATURE SENSOR

The most commonly measured physical parameter is temperature whether in process industry applications or in laboratory settings. Exact measurements are critical part of success. Exact measurements are needed for many applications such as medical

applications, materials research in labs, studies of electronic or electrical components,

biological research, and geological studies. Most commonly, temperature sensors are used to measure temperature in circuits which control a variety of equipment's.

There are different types of temperature sensors used in the market today including resistance temperature detectors (RTDs), thermocouples, thermistors, infrared sensor, and semiconductor sensors. Each of them has particular operating parameters. These sensors come in different varieties, but have one common thing: they all measure temperature by sensing a change in the physical characteristic.

A temperature sensor is a device, usually an RTD (resistance temperature detector) or a thermocouple, that collects the data about temperature from a particular source and converts the data into understandable form for a device or an observer. Temperature sensors are used in many applications like HV and AC system environmental controls, food processing units, medical devices, chemical handling and automotive under the hood monitoring and controlling systems, etc.

The most common type of temperature sensor is a thermometer, which is used to measure temperature of solids, liquids and gases. It is also a common type of temperature sensor mostly used for non-scientific purposes because it is not so accurate.

Types of Temperature Sensors

There are different types of temperature sensors that have sensing capacity depending upon their range of application. Different types of temperature sensors are as follows:

- Thermocouples
- Resistor temperature detectors
- Thermistors
- Infrared sensors
- Semiconductors
- Thermometers

4.1.6 HUMIDITY SENSOR:

Sometimes, after rains, the air feels moist. The water seems to have suspended in the air. However, in certain AC's you click some buttons and the atmosphere brightens up.

How and why does it all happen? Moisture forms up in the air, resulting in humidity. However, the humidity sensor in your AC picks it up and cleans it up for you. Isn't that

wonderful? Let's take a look at how it does that.

A humidity sensor (or hygrometer) senses, measures and reports both moisture and air temperature. The ratio of moisture in the air to the highest amount of moisture at a particular air temperature is called relative humidity. Relative humidity becomes an important factor when looking for comfort. Humidity sensors work by detecting changes that alter electrical currents or temperature in the air.

- Capacitive
- Resistive
- Thermal

All three types of sensors monitor minute changes in the atmosphere in order to calculate the humidity in the air. Let us discuss these types in detail:

Some parameters for judgement

So once you know what it is, and how it works, the next step probably would be to check its working. And how do you do that? By working through some of the below-mentioned parameters.

Accuracy

Every sensor has its own calibration curve, based on a 9 point system. It basically pitches the pros against the cons of the particular sensor.

Linearity

It indicates the voltage deviation from the BFSL value and the measured output voltage value, converted to relative humidity.

Reliability

The measurements often cause the sensor to fall out of sync. However for a sensor to be useful, it has to provide reliable measurements.

Repeatability

The measurements from a sensor, have to be so that they don't drift apart. Repeatability is the measurement of drift among measurements of a single quantity.

Response time

Typically, the time is taken by a sensor to rise to 66% (rise time) or fall to 33% (fall time) of maximum output voltage, is known as the response time.

Applications of humidity sensors are far and wide

The applications of humidity sensor range far and wide. People with illnesses affected by humidity, monitoring and preventive measure in homes employ humidity sensors. A humidity sensor is also found as part of home heating, ventilating and air conditioning systems (HVAC systems). These are also used in offices, cars, humidors, museums, industrial spaces and greenhouses and are also used in meteorology stations to report and predict the weather.

We list out some projects below for reference:

Humidity Indicator

Presented here are a simple humidity indicator and controller. In industries such as textile, the change in moisture content has a direct impact on the properties of fabric, such as tensile strength, elasticity, fibre diameter and friction. Cotton and linen require high relative humidity (RH) levels of around 70-80 per cent since they are very brittle. Wool requires RH levels of around 65 per cent. While silk requires between 65 and 70 per cent. With this circuit, you can not only monitor humidity levels between 30 and 90 per cent RH but also control it.

4.1.8 LCD 16X2:

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily

programmable; have no limitation of displaying special & even custom characters (unlike in

seven

segments), animations and

so

on.

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

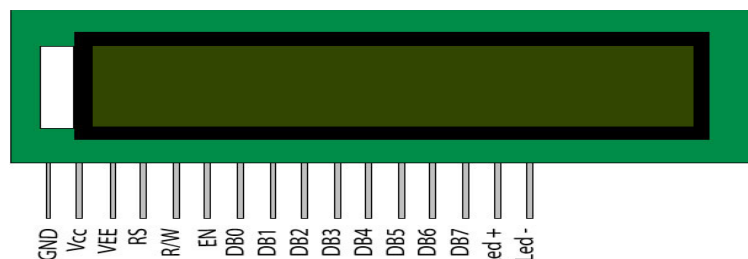


Fig 4.8 LCD DISPLAY

4.2 SOFTWARE REQUIREMENTS

ARDUINO IDE:

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast

prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

WRITING SKETCHES

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

FILE

New:

Creates a new instance of the editor, with the bare minimum structure of a sketch already in place.

Open:

Allows loading a sketch file browsing through the computer drives and folders.

Open Recent:

Provides a short list of the most recent sketches, ready to be opened.

Sketchbook:

shows the current sketches within the sketchbook folder structure; clicking on any name opens the corresponding sketch in a new editor instance.

Examples:

Any example provided by the Arduino Software (IDE) or library shows up in this menu item. All the examples are structured in a tree that allows easy access by topic or library.

Close:

Closes the instance of the Arduino Software from which it is clicked.

Save:

Saves the sketch with the current name. If the file hasn't been named before, a name will be provided in a "Save as.." window.

Save as:

Allows saving the current sketch with a different name.

Page Setup:

It shows the Page Setup window for printing.

Print:

Sends the current sketch to the printer according to the settings defined in Page Setup.

Preferences:

Opens the Preferences window where some settings of the IDE may be customized, as the language of the IDE interface.

Quit:

Closes all IDE windows. The same sketches open when Quit was chosen will be automatically reopened the next time you start the IDE.

EDIT:

Undo/Redo

Goes back of one or more steps you did while editing; when you go back, you may go forward with Redo.

Cut

Removes the selected text from the editor and places it into the clipboard.

Copy

Duplicates the selected text in the editor and places it into the clipboard.

Copy for Forum

Copies the code of your sketch to the clipboard in a form suitable for posting to the forum, complete with syntax coloring.

Copy as HTML

Copies the code of your sketch to the clipboard as HTML, suitable for embedding in web pages.

Paste

Puts the contents of the clipboard at the cursor position, in the editor.

Select All

Selects and highlights the whole content of the editor.

Comment/Uncomment

Puts or removes the // comment marker at the beginning of each selected line.

Increase/Decrease Indent

Adds or subtracts a space at the beginning of each selected line, moving the text one space on the right or eliminating a space at the beginning.

Find

Opens the Find and Replace window where you can specify text to search inside the current sketch according to several options.

Find Next

Highlights the next occurrence - if any - of the string specified as the search item in the Find window, relative to the cursor position.

Find Previous

Highlights the previous occurrence - if any - of the string specified as the search item in the Find window relative to the cursor position.

Sketch

Verify/Compile

Checks your sketch for errors compiling it; it will report memory usage for code and variables in the console area.

Upload

Compiles and loads the binary file onto the configured board through the configured Port.

Upload Using Programmer

This will overwrite the bootloader on the board; you will need to use Tools > Burn Bootloader to restore it and be able to Upload to USB serial port again. However, it allows you to use the full capacity of the Flash memory for your sketch. Please note that this command will NOT burn the fuses. To do so a Tools -> Burn Bootloader command must be executed.

Export Compiled Binary

Saves a .hex file that may be kept as archive or sent to the board using other tools.

Show Sketch Folder

Opens the current sketch folder.

Include Library

Adds a library to your sketch by inserting #include statements at the start of your code. For more details, see libraries below. Additionally, from this menu item you can access the Library Manager and import new libraries from .zip files.

Add File...

Adds a source file to the sketch (it will be copied from its current location). The new file appears in a new tab in the sketch window. Files can be removed from the sketch using the tab menu accessible clicking on the small triangle icon below the serial monitor one on the right side of the toolbar.

TOOLS

Auto Format

This formats your code nicely: i.e. indents it so that opening and closing curly braces line up, and that the statements inside curly braces are indented more.

Archive Sketch

Archives a copy of the current sketch in .zip format. The archive is placed in the same directory as the sketch.

Fix Encoding & Reload

fixes possible discrepancies between the editor char map encoding and other operating systems char maps.

Serial Monitor

Opens the serial monitor window and initiates the exchange of data with any connected board on the currently selected Port. This usually resets the board, if the board supports Reset over serial port opening.

Board

Select the board that you're using. See below for descriptions of the various boards.

Port

This menu contains all the serial devices (real or virtual) on your machine. It should automatically refresh every time you open the top-level tools menu.

Programmer:

For selecting a hardware programmer when programming a board or chip and not using the onboard USB-serial connection. Normally you won't need this, but if you're burning a boot loader to a new microcontroller, you will use this.

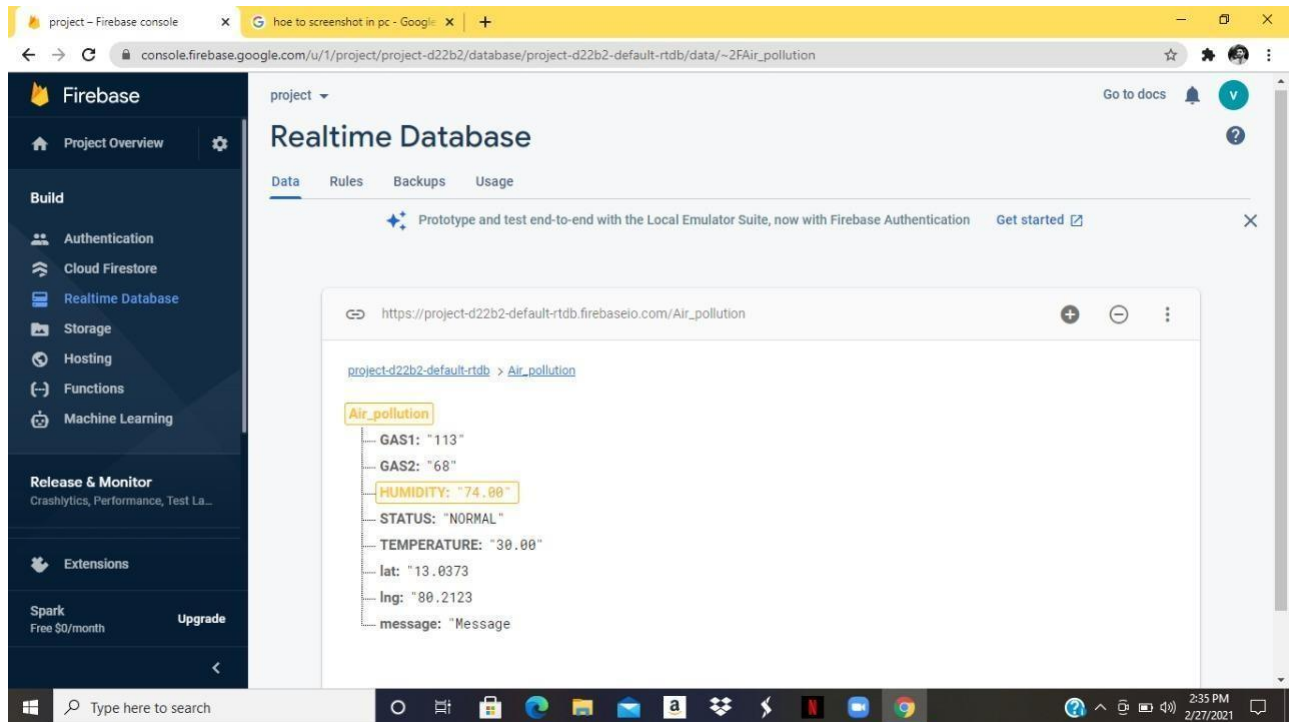
Burn Boot loader:

the items in this menu allow you to burn a boot loader onto the microcontroller on an Arduino board. This is not required for normal use of an Arduino or Genuine board but is useful if you purchase a new AT mega microcontroller (which normally come without a boot loader). Ensure that you've selected the correct board from the Boards menu before burning the boot loader on the target board. This command also set the right fuses.

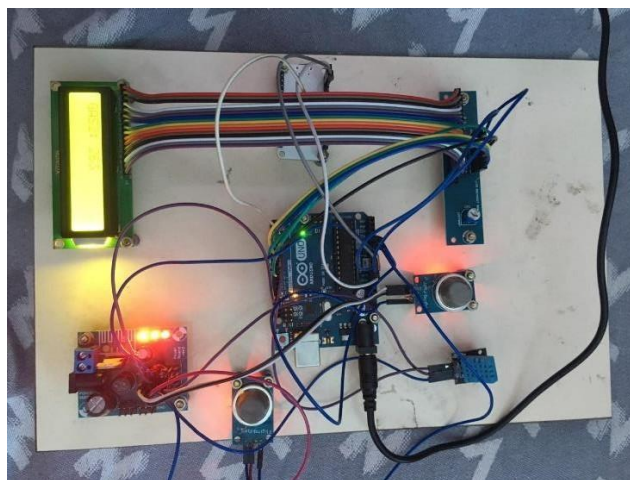
CHAPTER 5

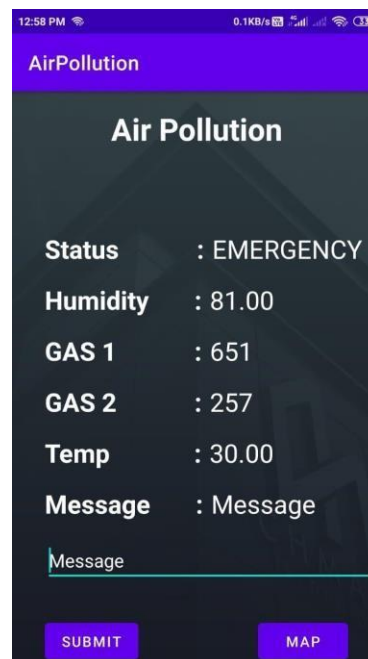
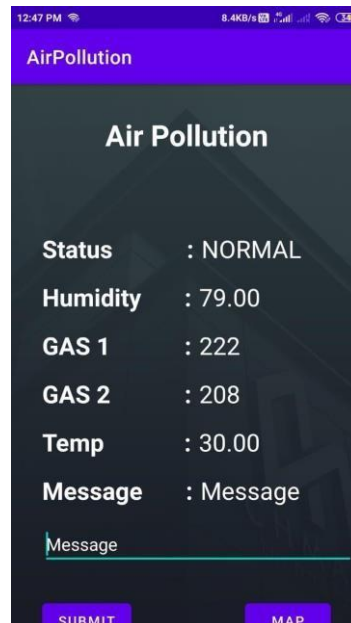
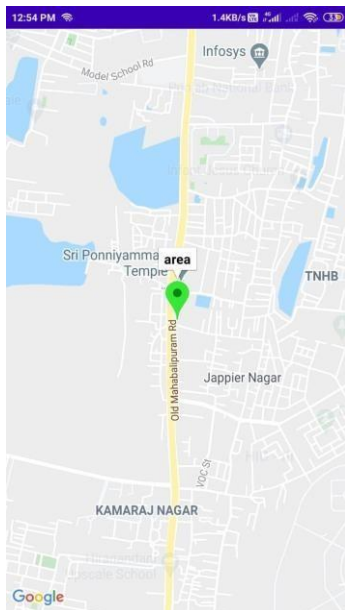
OUTPUT

Firestore output:



This image shows how the real time database works with the sensors the values are taken from the sensors and collected and displayed in lcd display and then the realtime database is connected with sensors the values will be collected and displayed in database





CHAPTER 6

CONCLUSION:

Reduce the level of pollution from such sources and to protect humans and the environment from harmful gasses, this air pollution kit was developed that helps a person to detect, monitor, and test air pollution in a given area . This system helps the as asthma patient

REFERENCES

1. D.Yaswanth, Dr Syed Umar,-" A Study on Pollution Monitoring system in Wireless Sensor Networks",-D.Yaswanth et al | IJCSET |September 2013 | Vol 3, Issue 9, 324-328.
2. Free, C., Phillips, G., Galli, L., Watson, L., Felix, L., Edwards, P., Patel, V., Haines, A.: The effectiveness of mobile-health technology-based health behaviour change or disease management interventions for health care consumers: a systematic review. PLoS medicine 10(1), e1001362 (2013)
3. Free, C., Whittaker, R., Knight, R., Abramsky, T., Rodgers, A., Roberts, I.: Txt2stop: a pilot randomised controlled trial of mobile phone-based smoking cessation support. Tobacco control 18(2), 88–91 (2009)
4. Gerharz, L.E., Pebesma, E.: Accounting for uncertainties and change of support in spatio-temporal modelling of individual exposure to air pollution. geoENV 2010 pp. 13–15 (2010)
5. Hagerstraand, T.: What about people in regional science? Papers in regional

science 24(1), 7–24 (1970)

6. Hasenfratz, D., Saukh, O., Sturzenegger, S., Thiele, L.: Participatory air pollution

monitoring using smartphones. In: Proc. 1st Intl Workshop on Mobile Sensing: From Smartphones and Wearables to Big Data (2012)

7. Heron, K.E., Smyth, J.M.: Ecological momentary interventions: incorporating mobile technology into psychosocial and health behaviour treatments. *British journal of health psychology* 15(1), 1–39 (2010)

8. Honicky, R., Brewer, E.A., Paulos, E., White, R.: N-smarts: networked suite of mobile atmospheric real-time sensors. In: *Proceedings of the second ACM SIGCOMM workshop on Networked systems for developing regions*. pp. 25–30. ACM (2008)

9. Hu, S.C., Wang, Y.C., Huang, C.Y., Tseng, Y.C.: Measuring air quality in city areas by vehicular wireless sensor networks. *Journal of Systems and Software* 84(11), 2005–2012 (2011) 18. Istepanian, R., Laxminarayan, S., Pattichis, C.S.: M-health: emerging mobile health systems. *MHealth: Emerging Mobile Health Systems*, Edited by R. Istepanian, S. Laxminarayan, and CS Pattichis. 2006 XXX, 624 p. 182 illus. 0-387-26558-9. Berlin: Springer, 2006. 1 (2006)

10. Istepanian, R.S., Pattichis, C.S., Laxminarayan, S.: Ubiquitous m-health systems and the convergence towards 4g mobile technologies. In: *M-Health*, pp. 3–14. Springer (2006)

11. Anil H. Sonune, S.M.Hambarde,-" Monitoring and Controlling of Air Pollution Using Intelligent Control System",-*International Journal of Scientific Engineering and Technology* ISSN: 2277-1581,Volume No.4 Issue No5, pp: 310-313.

12. Ma, Y., Richards, M., Ghanem, M., Guo, Y., Hassard, J.: Air pollution monitoring and mining based on sensor grid in london. *Sensors* 8(6), 3601–3623 (2008)

13. Milenković, A., Otto, C., Jovanov, E.: Wireless sensor networks for personal health monitoring: Issues and an implementation. *Computer communications* 29(13), 2521–2533 (2006) 22. Mun, M., Reddy, S., Shilton, K., Yau, N., Burke, J., Estrin, D., Hansen, M., Howard, E., West, R., Boda, P.: Peir, the personal environmental impact report, as a platform for participatory sensing systems research. In: *Proceedings of the 7th international conference on Mobile systems, applications, and services*. pp. 55–68. ACM (2009)

14. de Nazelle, A., Seto, E., Donaire-Gonzalez, D., Mendez, M., Matamala, J.,

Nieuwenhuijsen, M.J., Jerrett, M.: Improving estimates of air pollution exposure through ubiquitous sensing technologies. *Environmental Pollution* 176, 92–99 (2013)

15. Pantelopoulos, A., Bourbakis, N.G.: A survey on wearable sensor-based systems

for health monitoring and prognosis. Systems, Man, and Cybernetics, Part C: Applications and Reviews, IEEE Transactions on 40(1), 1–12 (2010)

16. Völgyesi, P., Nádas, A., Koutsoukos, X., Lédéczi, A.: Air quality monitoring with sensormap. In: Proceedings of the 7th international conference on Information processing in sensor networks. pp. 529– 530. IEEE Computer Society (2008)

17. Yoo, H., Park, M., Kim, T., Yang, S., Cho, G., Hwang, T., Baik, S., Choi, D., Park, G., Choi, K.: A ubiquitous chronic disease care system using cellular phones and the internet. Diabetic Medicine 26(6), 628–635 (2009).

18. Martinez, K., Hart, J. K., Ong, R., "Environmental Sensor Networks," IEEE Computer, Vol. 37, No. 8, pp. 50-56.

19. Nikheel A. Chourasia, Surekha P. Washimkar," ZigBee Based Wireless Air Pollution Monitoring" International Conference on Computing and Control Engineering(ICCCE 2012), 12 & 13 April, 2012

20. R. Rajagopalan and P.K. Varshney, "Data-Aggregation Techniques in Sensor Networks: A Survey," IEEE Communication Surveys and Tutorials, Vol. 8 (4), pp.48-63, December 2006.

21. Mainwaring, A., Polastre, J., Szewczyk, R., Culler, D.,Anderson, J. "Wireless Sensor Networks for Habitat Monitoring," ACM International Workshop on Wireless Sensor Networks and Applications, EUA.

21. Devarakonda, S., Sevusu, P., Liu, H., Liu, R., Iftode, L., Nath, B.: Real-time air quality monitoring through mobile sensing in metropolitan areas (2013)

22. Donner, J.: Research approaches to mobile use in the developing world: A review of the literature. The Information Society 24(3), 140–159 (2008)

23. Fjeldsoe, B.S., Marshall, A.L., Miller, Y.D.: Behavior change interventions delivered by mobile telephone short-message service. American journal of preventive medicine 36(2), 165–173 (2009)

APPENDIX

A. Source Code

```
#include "FirebaseESP8266.h"
#define FIREBASE_HOST "firedetection-69f6c.firebaseio.com"
#define FIREBASE_AUTH "EMp6cvxRhnFiwBlpkQ5AiEVF3sIlx2K79Hjq00hC"
#define WIFI_SSID "iotkit"
#define WIFI_PASSWORD "123456789"
#include <SoftwareSerial.h>
SoftwareSerial mySerial(5, 4);
String path0="/Air_polution";
String S,S1,S4,S5,S6,S7,S8;
char *S2;
char *S3[5];
int i=0;
FirebaseData firebaseData;
void setup()
{
  Serial.begin(9600);
  mySerial.begin(9600);
  WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
  while (WiFi.status() != WL_CONNECTED)
  {
    Serial.print(".");
    delay(300);
  }
  Serial.println();
  Serial.print("Connected with IP: ");
  Serial.println(WiFi.localIP());
  Serial.println();
  Firebase.begin(FIREBASE_HOST, FIREBASE_AUTH);
  Firebase.reconnectWiFi(true);
```

{

```

    Serial.println("connected");
}

}

void loop() {
    if(mySerial.available())
    {
        S=mySerial.readString();
        int e=S.indexOf("@");
        int e1=S.indexOf("#");
        int e2=S.indexOf("$");
        int e3=S.indexOf("%");
        int e4=S.indexOf("^");
        int e5=S.indexOf("&");
        S4=S.substring(e+1,e1);
        S5=S.substring(e1+1,e2);
        S6=S.substring(e2+1,e3);
        S7=S.substring(e3+1,e4);
        S8=S.substring(e4+1,e5);
        Serial.println(S4);
        Serial.println(S5);
        Serial.println(S6);
        Serial.println(S7);
        Serial.println(S8);

        String json="{\"HUMIDITY\": \" + S4 + \",\"TEMPERATURE\": \" + S5 + \",\"GAS1\": \" + S6
        + \",\"GAS2\": \" + S7 + \",\"STATUS\": \" + S8 + \"}";
        Firebase.setJSON(firebaseData,path0,json);
        /*Firebase.setString(firebaseData,"/Forest Fire Detection/TEMPERATURE",S5);
        Firebase.setString(firebaseData,"/Forest Fire Detection/GAS1",S6);
        Firebase.setString(firebaseData,"/Forest Fire Detection/GAS2",S7);*/
        Serial.println(json);
        //Firebase.setString(firebaseData,"/Forest Fire Detection/STATUS",S8);
    }
}

```



```

#include <LiquidCrystal.h>
const int rs = 9, en = 8, d4 = 7, d5 = 6, d6 = 5, d7 = 3;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
#include <dht11.h>
#define DHT11PIN 4// Analog Pin sensor is connected to

dht11 DHT11;

const int gasPin1 =
A0; const int gasPin2 =
A1; float hum,Temp;
String D;

void setup() {
  Serial.begin(9600);
  //Serial.println("DHT11 Humidity & temperature Sensor\n\n");
}

void loop()
{
  int chk = DHT11.read(DHT11PIN);
  hum=((float)DHT11.humidity);
  Temp=((float)DHT11.temperature);
  //Serial.print("temp: ");
  // Serial.println(Temp);
  // Serial.print("hum: ");
  //Serial.println(hum);

  int gas1 = analogRead(gasPin1);
  // Serial.print("GAS1: ");
  //Serial.println(gas1);
  delay(1000);

  int gas2 = analogRead(gasPin2);

```

```
//Serial.print("GAS2: ");
```

```

// Serial.println(gas2);
//delay(1000);

lcd.clear();
lcd.setCursor(0, 0);
lcd.print("GAS1: ");
lcd.print(gas1);
delay(1000);
lcd.clear();
lcd.setCursor(0, 1);
lcd.print("GAS2: ");
lcd.print(gas2);
delay(1000);
lcd.clear();
lcd.setCursor(0, 0);
lcd.print("TEMP: ");
lcd.print(Temp);
delay(1000);
lcd.clear();
lcd.setCursor(0, 1);
lcd.print("HUMIDITY: ");
lcd.print(hum);
delay(1000);
if(gas1>500 || gas2>500 || Temp>43)
{
D="EMERGENCY";
}
else if(gas1<500 && gas2<500 && Temp<45)
{
D="NORMAL";
}
Serial.println("@"+String(hum)+"#"+String(Temp)+"$"+String(gas1)+"%"+String(gas2)
)+"^"+D+"&");

```

delay(6000)

B. Journal Paper

IOT BASED AIR POLLUTION MONITORING MOBILE APP FOR ASTHMA PATIENT

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ABSTRACT: *The main obstacle in the current scenario is reduction of pollution in the air. This pollution in air carries very harmful particles which can harm the breathing system. Pre-birth openness to pollution in air has appeared to build the danger of panting and asthma improvement in kids. Diminishing generally speaking degrees of provincial air pollution through open strategies, setting up activities to diminish local area openness, building cushions between significant streets and the surroundings areas and limiting self to very own openness to the contaminating in air and thereby reducing the endangerment of creating asthma in youngsters as well as grownups. Existing observing frameworks have second rate accuracy very less affects, and should have the facility for researching the available frameworks, in regarding this we put forth the framework air pollution which is in third stage air pollution framework. This paper presents an Internet of Things (Iot) based wearable gadget incorporated with ease sensors and customer evaluated gadgets alongside a phone portable organization for ceaseless observing and the executives of asthma patients. Versatile application is actualized in this undertaking and this application is accustomed to checking pollution level noticeable all around. More sensor hub is utilizing to observing the general traffic pollution level in the specific region. This proposed framework is utilized to keep individuals from air pollution. Lessen the degree of adulteration from those origins and to shield people and the climate from unsafe gases, this air pollution pack was built up which motivates an individual to recognise, screen and check air pollution in a respective territory.*

Key words: *Internet of things (Iot), Arduino, Asthma, Mobile app, Air pollution.*

I INRODUCTION

Air contamination is a significant danger looked by all urban communities on the planet. In any case, in metropolitan urban areas, particularly in agricultural countries, the foundation for observing air quality is deficient. The public authority can't stand to introduce air contamination observing stations on account of the significant expense related with it. Besides, present-day checking arrangements are deficient in observing a few areas spread across the city. To successfully take care of the issue, an answer is required that gives an exact gauge of contamination progressively, just as be financially suitable for governments and nearby bodies to introduce it. This can be accomplished by conveying a Wireless Sensor Network. A Wireless Sensor Network comprises of a few hubs, called 'bits,' introduced at various areas. Every bit contains various gas and molecule sensors, a microcontroller, handset, and a force supply unit. Every bit gathers convergences of different gases and sends this information to the

base station for preparing and investigation. The information gathered by every bit is directed through the organization and sent to the base station by utilizing energy-effective steering calculations. When the information has arrived at the sink hub (base station) through the organization, it is transferred to the cloud by the sink hub. Whenever information is gathered and transferred to the cloud, it is prepared and dissected. With this information, a warmth map is plotted for different toxins just as the general Air Quality Index across the organization. This warmth guide will be accessible on a site and portable application for public review. The framework would consequently send email warnings to businesses surpassing the emanation levels dependent on guidelines set by government. This would likewise help controllers as particulars about infringement would be known.

People from metropolitan districts are uncommonly pretentious indoor pollutions and the indoor poisons CO & CO₂. An individual

contributes by far most of his energy in inside, so the air quality control is a ton of critical. The defenseless air quality may mess clinical up, less concentration in work, even surprising passing, etc Fundamental pollutants are PM 2.5, PM10, O3, NO2, SO2 and CO. NO2 is conveyed by vehicles and SO2 basically by the coal business. Receptiveness to such pollutants and traffic-related air contamination grows the peril of increases of asthma results. The best action to confine their transparency is to move, which it isn't for the most part possible.

During late years, air channels have been promoted to decrease home pollution, however their viability in asthma avoidance has not been experimentally illustrated. It turns out to be amazingly hard for an individual to take in dirtied air for he has the most elevated dangers of having a horrendous asthma assault [6]. Despite the fact that AQ checking the available and altered particularly for the asthma patients. As indicated by the United States Environment Protection Agency: Ozone triggers asthma as it is bothering to the lungs and the aviation routes airborne particles go through the nose or mouth cause Irritation in the windpipe (bodily fluid development) and mess breathing up. In short if the AQI (Air Quality Index) is 101 or higher, it's perilous with individuals experiencing asthma so much that they may need to change the exercises and prescriptions and even method of living. Manifestations likewise deteriorate in any event, when ozone levels are moderate from 50 to 100[7]. Asthma is a drawn out condition with quick beginning deteriorating of indications ('assaults') which can be erratic and may demonstrate deadly. Models anticipating asthma assaults require high affectability to limit mortality danger, and high particularity to maintain a strategic distance from pointless endorsing of safeguard meds that convey a related danger of antagonistic occasions. Along these lines, a precise sensor forecast is required with regards to tweaking it for asthma patients. To determine this issue sensor-based gadget has been created. The sensors are principle components for detecting the ecological information. For ongoing observing information approval and learning the information in the framework and finally alignment of devices significant. The information caught by inferior quality sensors may influence the nature of dynamic cycle [5]. At that point those blunders are adjusted by managing the mistakes to nothing. To sum things up, adjustment includes correlation of

acquired and standard estimation. After the qualities are gotten we input this information into an AI calculation which measures these informational indexes and predicts the odds of having asthma assault and give earlier admonitions and suggestions to the users[8].

Internet of things in APM screens the quality over a web laborer in air using Internet & this gives emergency alert at what time the QA goes down, suggests when there are satisfactory proportion of perilous gas existing observable all around corresponding smoke, CO2, alcohol, benzene, NH3, LPG and NOx. Versatile application is realized in this endeavor and this application is familiar with checking contamination level recognizable for what it's worth. More sensor center point are using to checking the overall traffic contamination level in the particular area.

II RELATED WORK

Reshi et al. [3] planned a WSN stage, called VehNode, that furnished cars with the ability to screen the degree of pollution s in smoke delivered by the vehicle. In another investigation by *De Nazelle et al. [5]* showed ecological detecting approaches that revitalized the mindfulness and compassion of people toward pollution. "Air pollution is a test that undermines essential human government assistance, harms normal and actual capital, and compels monetary development. We believe that this present writings will elucidate the expense of unpredictable losses into a financial language that reechoes with strategy producers so that many more valuables are going to get committed in betterment of the air standards.

Jahnvi Reddy ET AL[7] proposed about the quality over a web laborer in air using Internet & this gives emergency alert at what time the QA goes down, suggests when there are satisfactory proportion of perilous gas existing observable all around corresponding NH3, LPG and NOx. The LCD on the PPM will portray the quality of air simply on a page so that in order to make the air pollution check carry easily without any complications. The test is directed in a shut climate. They have utilized IOT Cloud (ThingSpeak) to store information lastly Software part to perform alignment the information. By and large issues in the proposed work gives the outcome that air Quality Stations

are costly and not convenient. Adjustment of sensors should be finished.

Devahema et al[8] The proposed work, they have utilized a generally powerful and effective gas sensor(i.e. MQ135) which can detect distinctive poisonous gases like NH₃, NO_x, liquor, Benzene, smoke, CO₂ which shows the outcome in PPM(Parts Per Million). At the point when it is associated with an Arduino then it will detect all gases, and will give the Pollution level in PPM. MQ135 gas sensor will give the yield in type of voltage levels and which must be changed over into PPM. You should revive the page over and over on the off chance that you need to see the current Air Quality Value in PPM , A nearby worker should be arrangement to exhibit its working and to screen the air quality from anyplace on the planet, we need port 80 (utilized for HTTP or web).

Mahantesh B Dalawai et al[9] utilized R5F100LEA microcontroller from Renesas RL78 arrangement containing contains of Flash ROM 64KB, RAM 4KB and Data Flash 4KB, and it has High speed on-chip oscillator, Self- reprogrammable under programming control, 58 GPIO's, and so on to execute his venture. The pollution level at every sensor hub can be given to worker by utilizing GSM/GPRS framework or we can show the pollution level data on enormous showcase near square. The fundamental point is that individuals who have commonly more than one substitute way to arrive at some objective. On the off chance that individual knows the pollution data ahead of time he can follow safe way and all the while pollution can likewise control. Executing sensors for recognizing dust, commotion, smoke and different boundaries isn't finished. Tedious in light of the fact that the pollution level from every vehicle on street must be perused.

III EXISTING SYSTEM

In this current framework is IoT-Mobair App for pollution the board, businesses based explicitly, smooth out and coordinate natural cycles, including air outflows investigations, water and energy the executives, and waste decrease. Existing checking frameworks have mediocre exactness, low affectability, and require research facility examination. Hence, improved checking frameworks are required. Such applications give perceivability to clients, explicitly enterprises into the danger of episodes like synthetic breaks, oil

slicks and harmful substances ill-advised removal, while consistence reinforcing with ecological guidelines and guidelines.

IV PROPOSED SYSTEM

In this proposed framework is street side pollution observing framework for asthma tolerant. We can likewise actualize zero resistance quick large information continuous stream scientific instruments to handle a particularly perplexing framework. Portable application is actualized in this undertaking and this application is accustomed to checking pollution level noticeable all around. More sensor hub is utilizing to observing the general traffic pollution level in the specific region. This proposed air pollution observing unit alongside the incorporated portable application can be useful to individuals experiencing respiratory illnesses. The application had following highlights, files of air quality for a particular city utilizing constant calculation, air quality day by day gauges, timing open air exercises for various suggestion of age, air quality plunges identified with wellbeing hazards, explicit reports for air quality estimates dependent on areas, and air quality guides age.

FIG 1 OVERVIEW OF THE PROPOSED SYSTEM

Over the square chart is contain power unit, ARM7 regulator, MQ-7, MQ-5, temperature sensor, GPRS modem. Gas sensor and temperature sensor are interfacing with traffic framework then it gets screen the pollution level in rush hour gridlock zone. This

sensor is interface with Arduino uno simple pins. The regulator which measures the sensor esteem and ship off worker room and

versatile application. Portable application is utilized to individuals for checking air pollution level. The pollution level is expanded the regulator is private to individuals and traffic worker room. This proposed framework is utilized to keep individuals from air pollution.

V RESULT AND DISCUSSION

The proof recommends that there is a connection between air pollution and asthma yet it isn't indisputable. The expanding predominance of asthma and the proceeding with increment in street traffic are both of concern. Observing the relationship among asthma and street traffic pollution would be valuable for general wellbeing purposes, both as far as observation and as far as impacting strategy. Strategy suggestions may incorporate directing of traffic, development of sidesteps, clog decrease plans, use of non- petroleum product vehicles and conceivably even the area of schools. An observing framework would utilize assessments of air pollution from street traffic which would be connected to information on asthma acquired from routine frameworks, like medical clinic affirmations, participation at mishap and crisis divisions or essential consideration counsels or to information from occasional overviews on wellbeing, including asthma pervasiveness.



FIG 2 RESULTS OF PROPOSED WORK

The proposed approach is autonomous of various types of respiratory infections, however contextual analysis has taken for asthma patients.

Pollution level is anticipated based the pre-recorded information of that specific area and we are utilizing dynamic calculation utilizing AI. At the point when the pollution level is past the limit esteem alert has been shipped off the android application. With the goal that it will alarm all individuals in the area. In the event that the pollution is more than expected, the model will begin the caution and peril sign will be demonstrated through red light and furthermore will begin the fumes fan to empty the toxin air. Contrasted with the current methodologies our methodology has given 98% of precision to the real pollution in the climate.

VII CONCLUSION

Right now, nonetheless, pollution is expanding step by step due to different reasons like mechanical development, advancement of auto enterprises, and substance businesses. To shield individuals and the territory from getting effected, from the obstacle gases, this air contamination pack was enlarged which urges one self to perceive, screen and examine air contamination is the respective district. This model main motive is to assist the customer in perceiving the degree of contamination in their locale. This proposed air contamination checking pack close by the organized convenient to people encountering. Abatement the amount of contamination from those sources and to protect the individuals and the habitat from precious fumes, this air contaminating unit was evolved that urges an individual recognise, screen and authenticate air contamination in particular zone. This system helps the as asthma understanding Pollution in earlier days was irrelevant.

REFERENCES:

- [1] A. Tamayo, C. Granell, and J. Huerta, "Using SWE standards for ubiquitous environmental sensing: A performance analysis," *Sensors*, vol. 12, no. 9, pp. 12026–12051, 2012.
- [2] G. L. Re, D. Peri, and S. D. Vassallo, "A mobile application for assessment of air pollution exposure," in *Proc. 1st Conf. Mobile Inf. Technol. Med. (MobileMed)*, 2013, pp. 1–4.
- [3] A. A. Reshi, S. Shafi, and A. Kumaravel, "VehNode: Wireless sensor network platform for automobile pollution control," in *Proc. IEEE Conf. Inf. Commun. Technol. (ICT)*,

2013, pp. 963–966.

[4] T. H. Mujawar, V. D. Bachuwar, and S. S. Suryavanshi, “Air pollution monitoring system in Solapur city using wireless sensor network,” in

Proc. Publ. Int. J. Comput. Appl. CCSN, 2013, pp. 11–15.

[5] A. De Nazelle et al., “Improving estimates of air pollution exposure through ubiquitous sensing technologies,” *Environ. Pollut.*, vol. 176, pp. 92– 99, May 2013

[6] Y. Zheng et al., “A cloud-based knowledge discovery system for monitoring fine-grained air quality,” Microsoft, Redmond, WA, USA, Rep. MSR-TR-2014-40, 2014. [Online]. Available: <http://research.microsoft.com/apps/pubs/default.asp> x

[7] N Jahnavi Reddy, Nikitha R Sherkhane “ POLLUTION MONITORING SYSTEM BASED ON IOT” , International Research Journal of Computer Science (IRJCS), Issue 06, Volume 6 (June 2019), SPECIAL ISSUE - 5th International Conference - “ACCE – 2019”

[8] Devahema , P.V. Sai Surya Vamsi ,Archit Garg , Abhinav Anand , Desu Rajasekhar Gupta “ IOT based Air Pollution Monitoring System” , Journal of Network Communications and Emerging Technologies (JNCET), Volume 8, Issue 4, April (2018).

[9] Mahantesh B Dalawai, Siva Yellampalli, Pradeep S.V, “IOT Based Air and Noise Pollution Monitoring in Urban and Rural Areas, Important Zones like Schools and Hospitals in Real Time.”, International e-Journal for Technology and Research-2017.

[10] Ms.Sarika Deshmukh, Mr. Saurabh Surendran,

Prof. M.P. Sardey, “Air and Sound Pollution Monitoring System using IoT” in International Journal on Recent and Innovation Trends in Computing and Communication, Volume: 5 Issue: 6, June 2017.

[11] Manish R.Deshmukh, Suraj J. Chavan, Renuka A. Chavan, Prof. Ganesh Atarde “IOT Based Air & Sound Pollution Monitoring System”, IJARIE- ISSN(O)-2395- 4396, Vol-4 Issue-3 2018.

[12] L.Ezhilarasi, K.Sripriya, A .Suganya , K.Vinodhini, ,”A System For Monitoring Air And Sound Pollution Using Arduino Controller With Iot Technology”, In International Research Journal In Advanced Engineering And Technology (Irjaet) E- Issn: 2454-4752 P - Issn : 2454-4744 Vol 3 Issue 2 (2017) Pages 1781 – 1785.

[13] K. B. Shaban, A. Kadri, and E. Rezk, “Urban air pollution monitoring system with forecasting models,” *IEEE Sensors Journal*, vol.16, no. 8, pp. 2598-2606, Apr. 2016.

[14] Dawit Uta Urku, Himanshu Agrawal, “Smart RealTime Indoor Air Quality Sensing System and Analytics”, International Journal of Engineering and Technology (IJET) DOI: 10.21817.

[15] Arushi Singh, Divya Pathak, Prachi Pandit, Shruti Patil, Prof. Priti. C. Golar, “IOT based Air and Sound Pollution Monitoring System” in International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 6, Issue 3, March 2017.

C. Plagiarism Report

AIR POLLUTION			
ORIGINALITY REPORT			
10%	9%	7%	4%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS
PRIMARY SOURCES			
1	ijariie.com Internet Source	2%	
2	Submitted to Chino Valley Unified School District Student Paper	1%	
3	Submitted to Universiti Malaysia Perlis Student Paper	1%	
4	www.xilirprojects.com Internet Source	1%	
5	www.jncet.org Internet Source	1%	
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